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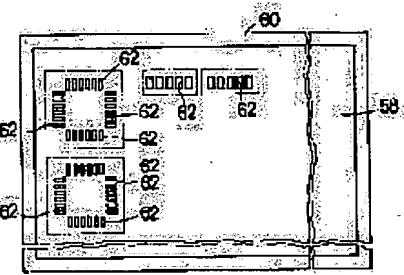
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(54) REFERENCE DATA FORMING DEVICE FOR SCREEN PRINTING MACHINE

(57)Abstract:

PURPOSE: To make it possible to easily and correctly form reference data for inspecting the printed result of screen printing.

CONSTITUTION: Onto a conveying device for conveying a screen 58 to an X-axis- and Y-axis-directions, a laser displacement sensor and a CCD camera are mounted. In advance of screen printing, the CCD camera is moved on the basis of the instructions of an operator to the desired shooting position in the screen 58 so as to obtain plane visual image in order to form reference data of the positions areas and volumes of through holes 62. After the screen printing, among the creamy solders printed on a printed board, the positions and heights of the creamy solders in the range corresponding to the visual image range of the screen 58 are detected with the laser displacement sensor so as to inspect defective printing such as the shifting of printed positions, the shortages of areas and of printed amounts. If defects are present the causes of defect are removed by replenishing creamy solder, cleaning the screen 58 and the like.



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TECHNICAL FIELD

[Industrial Application] this invention relates to easy-ization of data origination especially about the equipment which creates the criteria data for inspecting the printing result of a screen-stencil machine.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to easy-ization of data origination especially about the equipment which creates the criteria data for inspecting the printing result of a screen-stencil machine.

[0002]

[Description of the Prior Art] Like [in the case of applying adhesives and cream-like solder to the electronic-parts adhesion position and lead-wire connecting location of a printed circuit board], a screen-stencil machine is equipment which prints a printing agent to the position of a printed board, and is known by JP,1-63169,U etc. In this screen-stencil machine, a printing agent is printed by the printed board through the through hole generally formed in the screen when a squeegee moved in a screen top.

[0003] Thus, when printing a printing agent to a printed board, a defect may arise in printing. For example, a printing agent may not no longer be printed by all or a part of printing positions, the amount of printings may be insufficient, or a gap may arise in the printing position. Although it is based on causes, such as generating of the blinding with which a printing agent is got blocked in the through hole of a screen, shortage of a printing agent, and a position gap with a screen and a printed board, that such poor printing arises, if printing results, such as the amount of printings of a printing agent, the printing position and existence of printing, and printing area, are acquired and it inspects based on criteria data, it understands [whether a defect is in printing, and]. It is data used as the criteria for judging whether criteria data have a defect in a printing result, and when there is poor printing, good printing can be performed by removing the cause that the detected printing is poor.

[0004] Therefore, when printing cream-like solder to the former, for example, a printed circuit board, and inspecting the printing result, criteria data are created as follows. Cream-like solder is actually printed to a printed circuit board, the amount of printings, the printing position, printing area, etc. use as a model substrate the printed circuit board by which all were printed proper, and picturize the cream-like solder printed by the model substrate by the CCD camera, and the criteria data which inspect the amount of printings, the printing position, printing area, etc., respectively are created. Moreover, criteria data can also be created using the CAD data for creating a printed circuit board. CAD data are data for forming a circuit pattern in a printed circuit board, and since a circuit pattern shows the position in which the component part of an electronic circuitry is attached, electronic parts, resistance, the capacitor, etc. can create criteria data in quest of the amount of printings, the printing position, printing area, etc. of cream-like solder from the position.

[0005]

[Problem(s) to be Solved by the Invention] however, in creating a model substrate and creating criteria data Until cream-like solder is printed by the state where proper criteria data can be created at a printed circuit board That is, while it must screen-stencil until the cream-like solder of the almost optimal amount is printed in almost optimal position, area, etc., and many printed circuit boards become useless and criteria data origination takes time, there is a problem which creation of criteria data takes skill of an operator. When creating criteria data based on CAD data, CAD data need to be processed and data origination is troublesome. In order for being printed by some portions of the circuit pattern specified with CAD data to usually come out and to create criteria data for a certain reason, processing of CAD data is required for cream-like solder. Moreover, CAD data are data on a design, do not necessarily restrict expressing the state where it was actually printed proper using the screen, but have that it is inaccurate as criteria data for inspection of a printing result. These problems are problems produced similarly, when printing printing agents not only when printing cream-like solder to a printed circuit board, but other than cream-like solder to a printed circuit board, or when printing printing agents other than cream-like solder to printed boards other than a printed circuit board. It succeeds in this invention considering offering the criteria data origination equipment which can create easily and correctly the criteria data used as the inspection standard of the printing result of screen-stencil as a technical problem.

[0006]

[Means for Solving the Problem] a plane view image acquisition means to acquire the image in the plane view of the portion containing at least one through hole of the (a) screen in order that the criteria data origination equipment concerning this invention may solve the above-mentioned technical problem, and (b) -- it is constituted so that a criteria data origination means to create criteria data based on the image acquired by the plane view image acquisition means may be included

[0007]

[Function] If the image of the plane view of a screen is acquired, the position and area of a through hole are known. It is not necessary to necessarily acquire the image of the whole screen in that case. For example, what is necessary is to conduct

inspection only about a small through hole and just to acquire the image of the periphery of a small through hole in that case that it is generally easy to generate poor printing in a small through hole, since a high print quality is required. Moreover, a through hole may acquire the image of only a portion with the special situations that the portion which exists intensively, or a screen ends, such as a portion.

[0008] The position and area of a through hole are equivalent to the position and area of a printing agent which are printed to a printed board, and can create criteria data, such as the printing position of a printing agent, and printing area, based on a plane view image. Moreover, although the area of a through hole and the thickness of a screen show the volume of a through hole, this volume is the amount of printings of the printing agent which should be printed to a printed board, and can create the criteria data of the amount of printings.

[0009]

[Effect of the Invention] Thus, although criteria data can be created by acquiring the image of the plane view of a screen and adding the data of the thickness of a screen if needed according to this invention, if the screen itself used for printing is seen, area, a position, an amount, etc. of the printing agent which should actually be printed to a printed board can be known correctly, and can create criteria data with a sufficient precision. Moreover, it is not necessary to print a printing agent to many printed boards like [in the case of creating a model substrate], and skill of an operator cannot be required, but criteria data can be created quickly and cheaply.

[0010]

[Example] The case where this invention is hereafter applied to the screen-stencil machine which prints cream-like solder to a printed circuit board is taken for an example, and it explains in detail based on a drawing.

[0011] The screen-stencil machine of this example is equipped with screen-stencil equipment 10, the substrate conveyer 12, the screen transport device 14, screen hold equipment 16, and cleaning-for-screen equipment 18 as shown in drawing 1 and drawing 2. The substrate conveyer 12 is formed on the bed 22 prepared in position fixation, and has the fixed rail 24 and movable rail 26 which were arranged by X shaft orientations (it sets to drawing 1 and is the vertical direction). The rope which is not illustrated inside each rails 24 and 26, respectively is almost wound around endless, and the printed circuit board 28 as a printed board is laid on this rope, and is conveyed by X shaft orientations by moving a rope. The fixed rail 24 and the movable rail 26 are built over two or more screw-thread shafts 30, and a movable rail 26 approaches the fixed rail 24, is made to estrange by rotating the screw-thread shaft 30, and let the interval of rails 24 and 26 be an interval according to the size of a printed circuit board 28.

[0012] The screen-stencil equipment and composition of a publication are almost the same to JP,62-84871,A, and explain screen-stencil equipment 10 to it briefly. Screen-stencil equipment 10 is equipped with the printed circuit board positioning means for supporting 34, the screen positioning means for supporting 36, squeegee equipment 38, and substrate presser-foot equipment 40. Substrate presser-foot equipment 40 is formed on the bed 22 with the substrate conveyer 12 among these equipments. Substrate presser-foot equipment 40 has the substrate presser-foot board 42 moved to X shaft orientations, and when a printed circuit board 28 is supported by the printed circuit board positioning means for supporting 34, it plays the role which presses down a printed circuit board 28 from a top.

[0013] The printed circuit board positioning means for supporting 34, the screen positioning means for supporting 36, and squeegee equipment 38 are formed on the movable base 46 prepared on the bed 22 possible [movement to Y shaft orientations which intersect perpendicularly with X shaft orientations]. When only the distance of 1/2 is moved in a movable rail 26 and this direction when the width of face of the substrate conveyer 12 is changed, and the width of face of the substrate conveyer 12 is changed, the center of Y shaft orientations of the printed circuit board positioning means for supporting 34, the screen positioning means for supporting 36, and squeegee equipment 38 is made in agreement on the movable base 46 by the center of Y shaft orientations of the substrate conveyer 12.

[0014] The printed circuit board positioning means for supporting 34 have the substrate susceptor 50 as a printed board susceptor which is prepared possible [rise and fall] and made to go up and down in four steps of height positions by the multiple stroke cylinder which is not illustrated. This substrate susceptor 50 adsorbs a printed circuit board 28 by the vacuum, where a printed circuit board 28 is pinched with the substrate presser-foot board 42, and it goes up to the position where cream-like solder is printed.

[0015] The screen positioning means for supporting 36 and squeegee equipment 38 are supported by the frame 54 attached possible [rotation] on the movable base 46 at the circumference of an axis parallel to Y shaft orientations. The screen susceptor 56 is fixed to a frame 54, and as shown in drawing 3, a screen 58 and the screen frame 60 fixed to the periphery are supported.

[0016] As shown in a screen 58 at drawing 4 and drawing 5, many through holes 62 are formed. These through holes 62 are formed in the position corresponding to the position which connects electrodes, such as a position which connects the lead wire of the flat package type electronic parts of a printed circuit board 28, and resistance, a capacitor. The thickness of a screen 58 differs partially, as shown in drawing 5. For example, the lead wire of electronic parts is thin, since there is a possibility that a short circuit may occur if cream-like solder is not made little when the interval of an adjoining lead wire is narrow, while width of face of a through hole 62 is made into the size doubled with the size and interval of lead wire, thickness of a screen 58 is made thin and the amount of printings is lessened.

[0017] The aforementioned screen susceptor 56 is a rectangular frame, and among both **** parallel to X shaft orientations (it sets to drawing and is the vertical direction), in the screen transport device 14, while two Y shaft-orientations positioning equipments 64 separate distance to X shaft orientations and are formed in the frame section of an opposite side, respectively corresponding to two Y shaft-orientations positioning equipments 64, Y shaft-orientations press equipment 66 is formed in the frame section of another side. Moreover, the inside of the frame section parallel to Y shaft orientations (it sets to drawing and is

a longitudinal direction) of the screen susceptor 56, One X shaft-orientations positioning equipment 68 is formed in the frame section by the side of a frame 54. X shaft-orientations press equipment 70 is formed in the frame section of another side, and each press equipments 66 and 70 of each positioning equipments 64 and 68 of these Y shaft orientations and X shaft orientations, Y shaft orientations, and X shaft orientations constitute the screen positioning means for supporting 36.

[0018] Y shaft-orientations positioning equipment 64 sets up the position of Y shaft orientations of a screen 58, and as shown in drawing 6, it is equipped with the positioning lever 72 which can be rotated to the circumference of a perpendicular axis. This lever 72 was supported by the bracket 74 of fixation in the screen susceptor 56 possible [rotation], and is equipped with the two arm sections 76 and 78 which begin to be prolonged in the direction which differs in a phase. Rollers 80 and 82 are attached in the point of each arm sections 76 and 78 possible [rotation], respectively, it is energized by the sense which the upper arm section 76 estranges from the screen frame 60, and the roller 82 of the lower arm section 78 is made to contact at the nose of cam of a push rod 86 by the return spring 84.

[0019] A push rod 86 is screwed in the screw-thread shaft 92 combined with the output shaft of a step motor 90, and is moved to X shaft orientations by rotation of a step motor 90 while it fits into the block 88 of fixation to a bracket 74 possible [sliding of X shaft orientations]. A push rod 86 is advanced by rotation of the right direction of a step motor 90 (in drawing 6, it moves to a left), and the positioning lever 72 resists the energization force of a return spring 84, it rotates, and the upper arm section 76 approaches the screen frame 60. The arm section 76 is made to estrange from the screen frame 60 with rotation of the opposite direction of a step motor 90 by the return spring 84. Therefore, the position of the upper arm section 76, as a result Y shaft orientations of a screen 58 can be set up by setting up the move position of a push rod 86 suitably.

[0020] Y shaft-orientations press equipment 66 is equipped with the push lever 98 prepared in the screen susceptor 56 possible the rotation to the circumference of a perpendicular axis] with the shaft 96 as shown in drawing 3. The typeface of push lever 98 foil is accomplished and it connects with the piston rod 102 of a pneumatic cylinder 100 in the end section. The pneumatic cylinder 100 is attached in the screen susceptor 60 possible [the rotation to the circumference of a perpendicular axis]. the push lever 98 With the side connected with the piston rod 102 when a piston rod 102 was in retreat end position, the edge of an opposite side As a solid line shows, while it is located outside the side parallel to Y shaft orientations of the screen frame 60 As it is rotated by the sense close to the screen frame 60 when a piston rod 102 is moved toward advance end position, and a two-dot chain line shows It will engage with the side parallel to X shaft orientations of the screen frame 60, the screen frame 60 will be pushed against Y shaft-orientations positioning equipment 64, and the screen frame 60 will be positioned in Y shaft orientations by that cause.

[0021] In addition, the push lever 98 of Y shaft-orientations press equipment 66 formed in the downstream in the printed circuit board conveyance direction of the screen susceptor 56 As it has the arm section 104 which is attached in the upper part of a shaft 96 and is located in the screen susceptor 56 bottom, and the arm section 106 which is attached in the lower part of a shaft 96 and is located in the screen susceptor 56 bottom and a solid line shows When rotated by the position where the push lever 98 does not press the screen frame 60, It is made for the arm section 104,106 to have movement to the downstream (for it to set to drawing 3 and to be the bottom) of the printed circuit board conveyance direction barred in movement by the side of the screen transport device 14 (for it to set to drawing 3 and to be right-hand side), and X shaft orientations in Y shaft orientations of the screen frame 60.

[0022] X shaft-orientations positioning equipment 68 is constituted like Y shaft-orientations positioning equipment 64, and when the positioning lever 114 which has the two arm sections 110,112 is rotated by the energization force of the return spring by the step motor 118 for press of a push rod 116 which is not moved forward, retreated and illustrated, the position of X shaft orientations of the screen frame 60 is set up.

[0023] X shaft-orientations press equipment 70 is having the screen frame 60 pushed as shown in drawing 7, when the push lever 122 of the typeface of ** is rotated by the pneumatic cylinder 124. A slot 126 is formed in the screen susceptor 56, and the push lever 122 is attached in it possible [rotation] at the circumference of an axis parallel to Y shaft orientations. The end section of the push lever 122 is connected with the piston rod 128 of a pneumatic cylinder 124 possible [rotation], and is moved to the position where the other end of the push lever 122 projects on the screen susceptor 56, and pushes the screen frame 60 by expansion and contraction of a piston rod 128, and the position which withdrew from the upper surface of the screen susceptor 56 in the slot 126.

[0024] On the screen susceptor 56, the cylinder 134 for fixation is further formed in the four corners, respectively. Although the cylinder 134 for these fixation is formed downward, a piston rod is in contraction end position at the time of positioning of the screen frame 60 and it is made to estrange from the screen frame 60, after positioning, it is expanded and the screen frame 60 is fixed to the screen susceptor 56. In addition, two cylinders 134 for fixation prepared in the downstream (it sets to drawing 3 and is the bottom) in the conveyance direction of a printed circuit board 28 are formed in the position which does not bar movement in this direction of the screen frame 60.

[0025] Next, squeegee equipment 38 is explained. As shown in drawing 1, the aforementioned frame 54 and the frame 54 of the screen susceptor 56 have fitted in possible [sliding of slide 142] between the frames 138 of the portal set up by the portion of an opposite side while two guide rods 140 are formed in X shaft orientations. The squeegee unit 144 shown in drawing 8 is attached in the slide 142 possible [rise and fall], and it is made to go up and down by the position which contacts a screen 58 and prints cream-like solder in the cylinder 146 for rise and fall, and the position estranged from the screen 58. The slide 142 is screwed in the feed screw 148 in the nut 147, slide 142 is moved and the squeegee unit 144 is made to carry out both-way movement of it linearly by rotating a feed screw 148 by the servo motor 150 by X shaft orientations.

[0026] The squeegee unit 144 has the stirrer 154 long to the cross direction of a screen 58, and the syringe 158 in which the

cream-like solder 156 was held, as shown in drawing 8. The syringe 158 is attached in the casing 160 of a stirrer 154 removable, and the cream-like solder 156 flows in casing 160 in the state where it was attached in casing 160, with the low-pressure nitrogen gas and self-weight which are supplied in a syringe 158. Moreover, float 162 is floated on the cream-like solder 156. The iron ring 164 is inserted in the periphery of the disk made of synthetic resin, this float 162 changes, and when the first MAG switch 166 in which this ring 164 was formed out of the syringe 158 detects, it is detected that the amount of the cream-like solder 156 in a syringe 158 reached the amount of minimums. Out of a syringe 158, the second MAG switch 168 is formed from the first MAG switch 166 in an upper position again, and it is detected that the cream-like solder 156 in a syringe 158 reached the amount of upper limits.

[0027] Furthermore, the syringe 158 is connected to cream-like solder supply equipment 172 by the hose 170. Cream-like solder supply equipment 172 is laid on the aforementioned slide 142, and the cream-like solder held in the interior is always agitated by the stirrer, and is maintained at the viscosity suitable for printing. This cream-like solder supply equipment 172 supplies cream-like solder to a syringe 158 automatically based on supply instructions.

[0028] The casing 160 of a stirrer 154 is attached in the frame which is made to go up and down by the cylinder 146 for rise and fall and which is not illustrated possible [rotation]. In casing 160, while a shaft 176 is held possible [rotation], the churning roller 178 carries out eccentricity and is attached, and by being rotated by the drive motor which a shaft 176 does not illustrate, the churning roller 178 rotates, the cream-like solder 156 in casing 160 is agitated, and it maintains at the viscosity suitable for printing. While opening 180 is formed in the inferior surface of tongue of casing 160 -- the squeegee made of the rubber of a couple -- a member 182 is attached and the delivery 184 is formed these squeegees -- a member 182 is rotated for casing 160 by the surroundings of a shaft 176 in minute angle [every] right reverse both directions -- the move direction of the squeegee unit 144 -- setting -- the squeegee of an upstream -- a member 182 -- a screen 58 -- contacting -- the squeegee of a downstream -- a member 182 is made into the state where touch with a screen 58 was lost slightly

[0029] A screen 58 needs to exchange with change of the kind of printed circuit board 28. At the time of screen exchange, while a screen 58 is pulled out by the screen transport device 14 from the screen susceptor 58 and is held in screen hold equipment 16, another screen 58 is picked out from screen hold equipment 16, and is positioned on the screen susceptor 56.

[0030] The screen transport device 14 has the X-axis slide 188 which moves to X shaft orientations, and the Y-axis slide 190 formed possible [movement to Y shaft orientations] on the X-axis slide 188. The X-axis slide 188 is screwed in the ball thread 194, and is moved to X shaft orientations by rotating a ball thread 194 by the motor 196 for X shaft-orientations drive while it fits into the guide rail 192 of the couple arranged by X shaft orientations possible [sliding].

[0031] When the guide rail and ball thread which are not illustrated are arranged by Y shaft orientations and a ball thread is rotated by the motor 198 for Y shaft-orientations drive on the X-axis slide 188, the Y-axis slide 190 is moved to Y shaft orientations. The interior material 200 of a proposal of a tabular is formed in the X-axis slide 188 in parallel with Y shaft orientations again.

[0032] Moreover, the longitudinal configuration where the Y-axis slide 190 is long to Y shaft orientations -- accomplishing -- the point inferior surface of tongue -- engagement of the typeface cross section of KO -- the member 202,204 is attached engagement -- the member 202 is energized up with the spring which is not illustrated while being dropped by the cylinder 206 for descent, and is attached in the sense from which the side attachment wall of the couple of the character of KO becomes parallel to X shaft orientations engagement -- a member 204 -- engagement -- it is attached in the sense from which the side attachment wall of the couple of the character of KO becomes parallel to Y shaft orientations although made to go up and down with the cylinder 208 for descent, and a spring like a member 202

[0033] Moreover -- the back end side of the Y-axis slide 190 -- engagement of the engagement pin 212 and the typeface cross section of KO -- a member 214 and the supporter material 216 are attached engagement -- a member 214 is attached in the sense from which the side attachment wall of the couple of the character of KO becomes parallel to Y shaft orientations -- having -- **** -- the engagement pin 212 and engagement -- a member 214 is made to all go up and down with the cylinder for descent, and a spring. Moreover, the supporter material 216 is arranged in parallel with X shaft orientations.

[0034] Furthermore, the laser displacement sensor 220 is attached in the point of the Y-axis slide 190. As shown in drawing 9, the laser displacement sensor 220 irradiates the cream-like solder 156 which condensed the laser beam which the laser beam generator 222 emits with the floodlighting optical system 224, and was printed on the printed circuit board 28, condenses the reflected light on the semiconductor position sensing element 228 with the light-receiving optical system 226, and it is constituted so that a reflected light condensing position may be calculated in the analog data-processing circuit 230. Since the condensing position on the semiconductor position sensing element 228 changes with the height of the cream-like solder 156, the operation of the condensing position shows the position where the cream-like solder 156 on a printed circuit board 28 was printed, and its height.

[0035] It is based on the Y-axis slide 190 laser displacement sensor 220 again that it seems that it is shown in drawing 1, and CCD camera 232 is attached at the nose of cam. CCD camera 232 is moved to the arbitrary positions in the level surface by movement of the X-axis slide 188 and the Y-axis slide 190.

[0036] The screen hold section 236 is formed in two steps at the casing 234, and screen hold equipment 16 is alternatively positioned in a screen delivery position, when casing 234 is made to go up and down by the cylinder 238 for rise and fall. The automatic exchange of a screen is the same as that of the screen-stencil machine of a publication to JP,1-317768,A, and is briefly explained to it.

[0037] the engagement prepared in the Y-axis slide 190 when a screen 58 was exchanged with change of the kind of printed circuit board 28 -- a member 202 makes it engage with the screen frame 60 -- having -- the screen frame 60 -- Y shaft

orientations from the screen susceptor 56 -- setting -- almost -- a half length drawer -- the engagement pin 212 is made to engage with the screen frame 60 the back the bottom, and it pulls out from the screen susceptor 56, making the screen frame 60 whole guide the interior material 200 of an by moving the X-axis slide 188 in the state, the screen frame 60 is pushed by the interior material 200 of a proposal -- having -- the screen hold equipment 16 side -- the length of X shaft orientations -- a half grade carries out distance movement mostly -- having -- the engagement from the state -- when a member 214 engages with the screen frame 60 and moves to X shaft orientations, the screen frame 60 is held in the upper screen hold section 236 And the lower screen hold section 236 is positioned in a screen delivery position, and the screen 58 used for a degree is conveyed and positioned on the screen susceptor 56 in a procedure contrary to the case where a screen 58 is held, and it is used for screen-stencil.

[0038] Next, cleaning-for-screen equipment 18 is explained. Cleaning-for-screen equipment 18 is formed in the downstream (it sets to drawing 1 and is the bottom) in the conveyance direction of a printed circuit board 28 to the screen-stencil equipment 10 of a bed 22. As shown in drawing 1, the guide rail 248 of a couple is formed in the substrate conveyer [of a bed 22] 12, and cleaning-for-screen equipment 18 bottom, and it considers as the guide at the time of the screen frame 60 being taken down from the screen susceptor 56.

[0039] Cleaning-for-screen equipment 18 is formed by width of face slightly smaller than width of face when the fixed rail 24 and movable rail 26 of the substrate conveyer 12 are opened by the maximum, and as shown in drawing 2, it has the ramp 250 established in the bed 22 possible [rise and fall]. Four guide rods 252 are fixed to the inferior surface of tongue of a ramp 250, while fitting into the bush 254 prepared in the bed 22 possible [sliding], the piston rod 258 of the cylinder 256 for rise and fall held in the bed 22 is connected, and a ramp 250 is made to go up and down by expansion and contraction of a piston rod 258.

[0040] On the ramp 250, it was prepared in the sense to which gold [of a couple / a guy / 262] extends in X shaft orientations, and the slide 264 has fitted in possible [sliding]. As slide 264 is shown in drawing 10, it is screwed in the ball thread 266 prepared on the ramp 250 in the nut 268 (refer to drawing 2), and slide 264 is moved to X shaft orientations by rotating a ball thread 266 by the drive motor 270. On this slide 264, the brush 274 long to Y shaft orientations is attached possible [rotation] with the shaft 276 at the circumference of an axis parallel to Y shaft orientations.

[0041] A shaft 276 is rotated by rotation of the pulley of fixation in the end section and the motor 280 for a rotation drive transmitted by belt 278 grade as shown in drawing 2. On the slide 264, as shown in drawing 10 and drawing 11, the solvent jet nozzle 284 and the solvent feeder 286 are formed again, and the solvent for dropping the cream-like solder 156 is injected toward a screen 58 by the principle of an atomizer from the solvent jet nozzle 284. On the slide 264, the vacuum aspirator 290 is further formed along with the brush 274. It connects with the vacuum device 292 (refer to drawing 12), and the vacuum aspirator 290 attracts the cream-like solder 156 which adhered to the brush 274 by supply of a vacuum.

[0042] This screen-stencil machine is controlled by the control unit 300 shown in drawing 12. This control unit 300 makes a subject the computer which has the bus 308 which connects CPU302, ROM304, RAM306, and them. the input interface 310 connects with a bus 308 -- having -- the aforementioned first and second MAG switches 166 and 168 and laser -- a variation rate -- the sensor 220, CCD camera 232, and the input unit 311 are connected. The input unit 311 is equipped with the numerical keypad, the alphabet key, the operation key, etc., and is used for the manual operation of the equipment which constitutes entries of data, such as thickness of a screen 58, the substrate conveyer 12 and screen transport-device 14 grade, and this screen-stencil machine etc.

[0043] The output interface 312 is connected to a bus 308 again, and the drive circuits 316, 318, 320, 322, 324, 326, 328, 330, 332, and 334,336,338,340 are minded. Step motors 90 and 118, the cylinder 134 for fixation, the cylinders 100 and 124 for press, solder supply equipment 172, the cylinder 256 for rise and fall, the motor 270 for movement, the motor 280 for a rotation drive, the solvent feeder 286, a vacuum device 292, the motor 196 for X shaft-orientations drive, The motor 198 for Y shaft-orientations drive is connected. In addition, although the motor for driving screen-stencil equipment 10 and the substrate conveyer 12 other than these etc. is connected, only the deep thing of relation is illustrated to explanation of this invention here, and illustration is omitted about connection of other members.

[0044] Next, an operation is explained. In advance of the start of screen-stencil, a screen 58 is positioned on the screen susceptor 56, and it is picturized by CCD camera 232. In this case, screen 58 all are not picturized but only the range directed by the operator is picturized. Among printed circuit boards 28, the position which poor printing, such as shortage of the amount of printings and a gap of the printing position, produces was decided generally, and the portion corresponding to the position of a screen 28 is picturized.

[0045] At the time of an image pck-up, the member which absorbs light is put on the screen 58 bottom, and the through hole 62 of a screen 58 and portions other than through-hole 62 distinguish, and are picturized by the existence of the reflected light. An operator points to movement of the X-axis slide 188 and the Y-axis slide 190 with an input unit 311, and moves CCD camera 232 to a desired image pck-up position. As this image pck-up position is shown in drawing 4, the range surrounded with the alternate long and short dash line among screens 58 is picturized, the image acquisition position data and image pck-up data of CCD camera 232 match, and it is stored in RAM. Moreover, the design specifications of a screen 58 show the thickness of a screen 58 beforehand, and simultaneously with an image pck-up, the thickness of the screen 58 of an image acquisition position is inputted by the operator, and is stored in RAM with image acquisition position data and image pck-up data.

[0046] If all the portions that should be picturized among screens 58 are picturized, in a control unit 300, each criteria data of the printing position (a flat-surface configuration is included) of cream-like solder, printing area, and the amount of printings will be created based on image acquisition position data, image pck-up data, and thickness data. It is based on image acquisition position data and image pck-up data, and the criteria position data in the screen 58 of a through hole 62 are created. In this case, when

through holes 62 are a rectangle and a square, the position of three vertices is called for, respectively and it considers as criteria position data, and when a through hole 62 is circular, a main position is called for, and it considers as criteria position data. Criteria position data are matched with the number of the image pck-up range, and are stored in RAM306.

[0047] Moreover, the area of a through hole 62 is computed based on image pck-up data, and datum-level product data match with the position data of a through hole 62, and are stored in RAM306. Furthermore, based on datum-level product data and thickness data, the criteria volume data of a through hole 62 are called for. The amount of printings of the cream-like solder 156 is expressed, the amount data of printings are created, and the volume of a through hole 62 is matched with the position data of a through hole 62, and is stored in RAM306.

[0048] At the time of screen-stencil, the width of face of the substrate conveyer 12 is adjusted by the size according to the width of face of a printed circuit board 28. And if a printed circuit board 28 is conveyed just under a screen 58 by substrate conveyer 12, positioning support will be carried out by the substrate susceptor 50, and it will be raised to the printing position, and will be stuck on the undersurface of a screen 58. The squeegee unit 144 is moved in the state, and the cream-like solder 156 is printed by the printed circuit board 28 through a screen 58.

[0049] A printed circuit board 28 is dropped, and it is made to estrange from a screen 58 after a printing end, and is positioned by the pointing device which is not illustrated while being taken out by the downstream of screen-stencil equipment 10 by substrate conveyer 12. Subsequently, while the reference mark of a printed circuit board 28 is read by the laser displacement sensor 220, the printing state of the cream-like solder 156 is detected. movement of the X-axis slide 188 of the screen transport device 14, and the Y-axis slide 190 -- laser -- a variation rate -- although the position and height of the cream-like solder 156 which the sensor 220 moved in the printed circuit board 28 top, and were printed are detected, only the position and height of the cream-like solder 156 of the range corresponding to the image pck-up range of the screen 58 previously picturized by CCD camera 232 are detected in this case the position data of a through hole 62 correct based on the locational error of the printed circuit board 28 computed based on the read of a reference mark -- having -- the laser at the time of the image pck-up of the cream-like solder 156 -- a variation rate -- the mobile data of a sensor 220 creates -- having -- the mobile data -- being based -- laser -- a variation rate -- a sensor 220 is moved and the position and height of the cream-like solder 156 are detected

[0050] The printing position, printing area, and the amount of printings are computed every cream [which was printed]-like solder 156 after detection. Real printing-position data and real printing area data are called for from image pck-up data, are matched with the number (it is the same as the number of the image pck-up range at the time of a screen image pck-up) of the detection range, and are stored in RAM306. The amount of printings is calculated from the height of each part of the cream-like solder 156, and the amount data of real printings are matched with the number of the detection range, and are stored in RAM306.

[0051] Next, in a control unit 300, a printing result is inspected based on criteria data. Success or failure is investigated by the error row of the printing position, printing area, and the amount of printings.

[0052] First, it is investigated about printing area. Real printing area data are compared with datum-level product data, and if real area is more than the rate of a constant ratio of a datum-level product and it is success and the following, it will consider as a rejection. And although it is success in the great portion of printing position, when the distribution state of a position where the cream-like solder 156 is printed is a rejection in the printing position of **** part, the cause is the blinding of the hole of a screen 58, and cleaning-for-screen equipment 18 is operated to it.

[0053] First, while fixation of the screen frame 60 in the cylinder 134 for fixation is solved Press of the screen frame 60 by each press equipments 70 and 66 of X shaft orientations and Y shaft orientations is solved. Subsequently, the X-axis slide 188 and the Y-axis slide 190 of the screen transport device 14 are moved. engagement -- a member 204 is made to engage with the frame section parallel to Y shaft orientations of the screen frame 60, the screen frame 60 is guided by movement of the X-axis slide 188 by the guide rail 248, and it is pulled out on cleaning-for-screen equipment 18 from the screen susceptor 56

[0054] Along with a screen 58, it is moved by slide 264, a ramp 250 being raised, a brush 274 being contacted on the undersurface of a screen 58, and a brush 274 being rotated, after the substrate conveyer 12 is able to extend at the maximum interval in the state, and the cream-like solder 156 got blocked in the pinhole of a screen 58 is removed. Under the present circumstances, a solvent is hung on a screen 58 by the solvent jet nozzle 284, while the cream-like solder 156 adhering to the screen 58 is removed, the cream-like solder 156 adhering to the brush 274 is attracted by the vacuum aspirator 290, and the cream-like solder 156 got blocked in the pinhole of a screen 58 is removed finely.

[0055] Moreover, it is performed by measuring the amount of real printings, and the amount of criteria printings about every one of the printed cream-like solder 156 whether there are few amounts of printings of the cream-like solder 156 than a regular amount. In a certain case, the position of cream-like solder 156 in a syringe 158 whose amount of real printings is below the rate of a constant ratio of the amount of criteria printings decreased more than the predetermined number, operation instructions are issued by cream-like solder supply equipment 172, and the cream-like solder 156 is supplied to a syringe 158. This supply is the minute pressure which is the grade by which the cream-like solder 156 is not breathed out from a delivery 184, and it is performed until the ring 164 of float 162 is detected by the second MAG switch 168.

[0056] In addition, if shortage of the cream-like solder 156 in a syringe 158 is detected by the first MAG switch 166, based on the detection, the cream-like solder 156 will be supplied by cream-like solder supply equipment 172. However, even if shortage of the cream-like solder 156 is not detected or it is detected by failure of the first MAG switch 166 or the incorrect operation of a control unit 300, the cream-like solder 156 may not be supplied. In this case, since it is detected based on the printing state to a printed circuit board 28 as mentioned above and the cream-like solder 156 is supplied based on the detection, shortage of the cream-like solder 156 can continue printing convenient. Generating of the abnormalities of the first MAG switch 166 or a control

unit 300 can be used for an unusual diagnosis, a maintenance, etc. of equipment by understanding from that the cream-like solder 156 is supplied and the second MAG switch 168 emits a signal or supply of the cream-like solder 156 having been performed based on detection of a printing state, and memorizing this, in spite of not supplying a signal from the first MAG switch 166. [0057] Comparison with the real printing position and the criteria printing position shows whether the position where the cream-like solder 156 was printed has shifted from the regular position about every one of the cream-like solder 156. When a gap of the printing position is more than a permissible dose, the position of a screen 58 is corrected. In this case, the correction direction and the amount of corrections of a position of a screen 58 are computed, first, after fixation of the screen frame 60 in the cylinder 134 for fixation and the press by the press equipments 66 and 70 are canceled, a step motor 90,118 is started and the position of the positioning lever 72,114 is corrected. The position of a screen 58 is corrected to the position where it does not shift to a printed circuit board 28, and the cream-like solder 156 is printed after correction by pressing the screen frame 60 and being pushed against the positioning lever 72,114 by the press equipments 70 and 66 of X shaft orientations and Y shaft orientations. Each press equipments 70 and 66 of each positioning equipments 68 and 64 of X shaft orientations and Y shaft orientations and X shaft orientations, and Y shaft orientations function as screen position correction equipment which corrects automatically the position on the screen susceptor 56 of a screen 58.

[0058] In this example, a plane view image acquisition means by which CCD camera 232 acquires the image in the plane view of a screen 58 is constituted, and the control unit 300 constitutes the criteria data origination means so that clearly from the above explanation.

[0059] in addition, in the above-mentioned example, the plane view image of a screen 58 acquires by CCD camera 232 -- having -- the cream-like solder 156 -- laser -- a variation rate -- although detected by the sensor 220 -- any -- CCD camera 232 or laser -- a variation rate -- you may acquire by the sensor 220

[0060] moreover, the above-mentioned example -- setting -- laser -- a variation rate -- although the cream-like solder 156 which was made to move a sensor 220 to X shaft orientations and Y shaft orientations, and was printed is detected -- laser -- a variation rate -- after moving a sensor 220 to the detection position upper part, you may make it detect the cream-like solder 156 by changing the direction of radiation of a laser beam

[0061] Furthermore, a CCD camera is good as what obtains an image in a field, or good also as what is obtained in the shape of a line. Anyway, in order to distinguish a printed circuit board 28 and the cream-like solder 156, it is desirable to use the CCD camera of a color.

[0062] Moreover, although the plane view image of a screen 58 is acquired in the above-mentioned example by CCD camera 232 which attached the screen 58 in the screen-stencil machine, and was prepared in the screen-stencil machine, apart from a screen-stencil machine, the image pck-up equipment of exclusive use is formed, and you may make it acquire the plane view image of a screen 58.

[0063] In addition, it is also possible to give the function to detect the solder bridge where cream-like solder 156 comrades printed by the different printing position are connected. And since it is dirt of the rear face of a screen 58, if a solder bridge is generated, as for one of the causes of solder bridge generating, it will be desirable for cleaning of a screen 58 to be made to be performed first. However, when the viscosity of the cream-like solder 156 and change of the quality of the material are one of the causes of solder bridge generating and generating of a solder bridge is not canceled by cleaning of a screen 58, poor generating is reported to an operator and an operator performs check of printing conditions or the cream-like solder 156.

[0064] Furthermore, although the downstream of screen-stencil equipment 10 is made to move a printed circuit board 28 in the above-mentioned example at the time of detection of the cream-like solder 156, a screen 58 is evacuated from on a printed circuit board 28, and you may make it detect the cream-like solder 156 after printing.

[0065] Moreover, cleaning-for-screen equipment is good also as what is removed by the vacuum while it blows away the cream-like solder adhering to the inner skin of a through hole 62 by the compressed air like the cleaning-for-screen equipment indicated by the specification of Japanese Patent Application No. No. 31580 [four to] concerning these people.

[0066] Furthermore, you may make it change a printing pressure so that a printing pressure shall be partially changed in the move direction of a squeegee, and the direction which intersects perpendicularly and the proper amount of printings may be obtained according to the distribution of the amount of printings as the specification of Japanese Patent Application No. No. 31580 [four to] concerning this application indicates screen-stencil equipment.

[0067] Moreover, although only some plane view images of a screen 58 are acquired in the above-mentioned example, a plane view image is acquired about all of screens 58, all the cream-like solder 156 printed also about the printed circuit board 28 is detected, and you may make it inspect a printing result.

[0068] Furthermore, a poor cause stripper should just be equipment from which cleaning-for-screen equipment 18, the screen positioning means for supporting 36, and not only cream-like solder supply equipment 172 but a printing poor cause can be removed automatically.

[0069] In addition, this invention can be carried out in the mode which gave various deformation and improvement based on this contractor's knowledge, without deviating from a claim.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] Equipment which creates the criteria data used as the inspection standard of the printing result in the screen-stencil machine which prints a printing agent to a printed board through two or more through holes formed in the screen when a squeegee moved in the screen top characterized by providing the following. A plane view image acquisition means to acquire the image in the plane view of the portion containing at least one aforementioned through hole of the aforementioned screen. A criteria data origination means to create the aforementioned criteria data based on the image acquired by the plane view image acquisition means.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the plan showing roughly the screen-stencil machine equipped with the criteria data origination equipment which is one example of this invention.

[Drawing 2] It is the side elevation showing the screen-stencil equipment and cleaning-for-screen equipment of the above-mentioned screen-stencil machine.

[Drawing 3] It is the plan showing the screen positioning means for supporting of the above-mentioned screen-stencil equipment.

[Drawing 4] It is the plan showing the screen used in the above-mentioned screen-stencil equipment.

[Drawing 5] It is the side cross section showing some above-mentioned screens.

[Drawing 6] It is the transverse-plane cross section showing Y shaft-orientations positioning equipment of the above-mentioned screen positioning means for supporting.

[Drawing 7] It is the front view showing X shaft-orientations press equipment of the above-mentioned screen positioning means for supporting.

[Drawing 8] It is the transverse-plane cross section showing the squeegee unit of the above-mentioned screen-stencil equipment.

[Drawing 9] the laser which detects the cream-like solder printed by the printed circuit board -- a variation rate -- it is drawing explaining the principle of a sensor

[Drawing 10] It is the plan showing the above-mentioned cleaning-for-screen equipment.

[Drawing 11] It is the front view of the above-mentioned cleaning-for-screen equipment.

[Drawing 12] It is the block diagram of the control unit which controls the above-mentioned screen-stencil machine.

[Description of Notations]

10 Screen-stencil Equipment

28 Printed Circuit Board

38 Squeegee Equipment

58 Screen

62 Through Hole

220 Laser Displacement Sensor

232 CCD Camera

300 Control Unit

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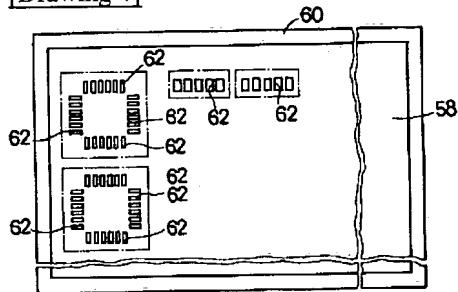
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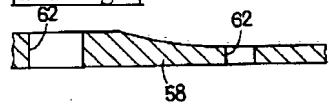
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DRAWINGS

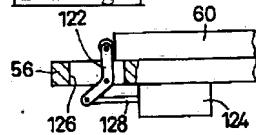
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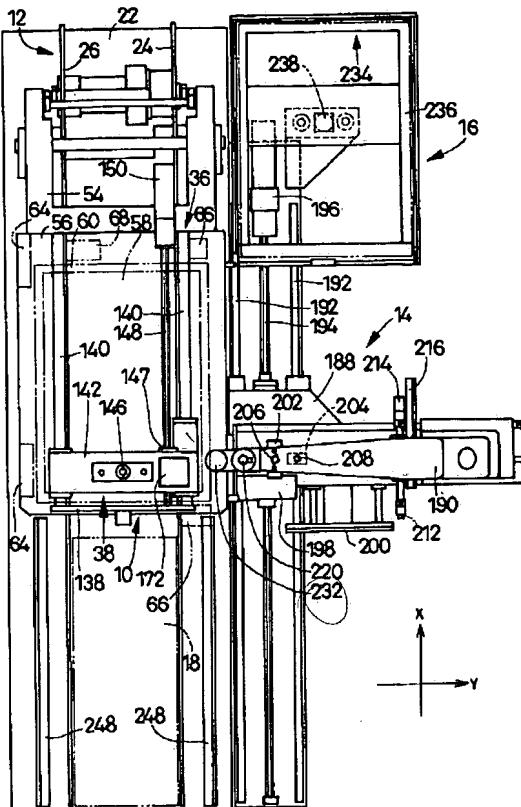
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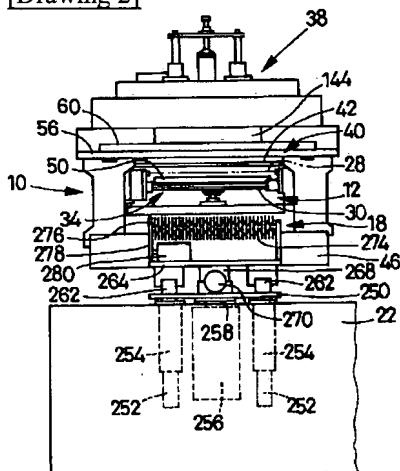
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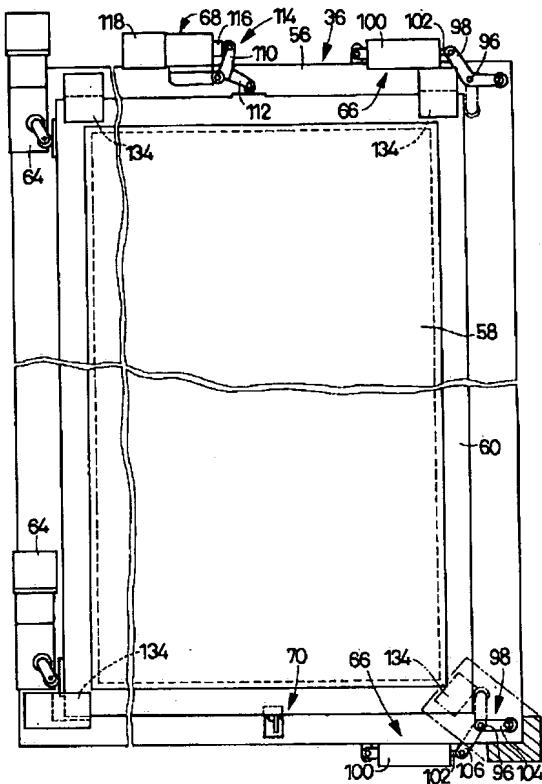
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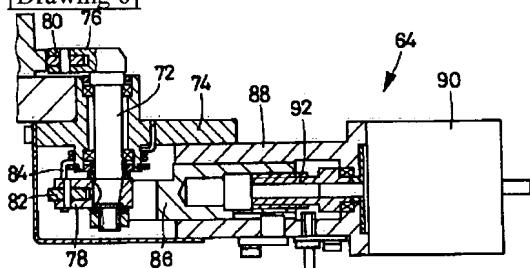
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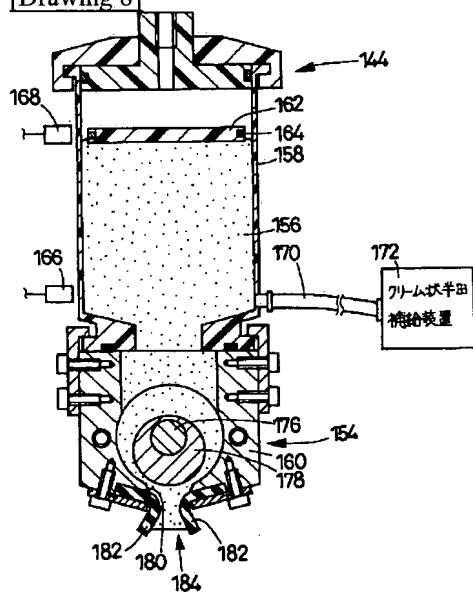
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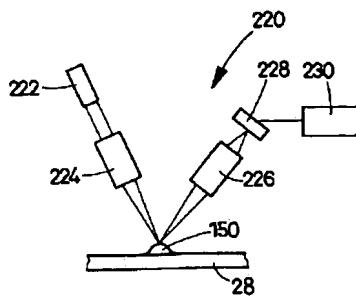
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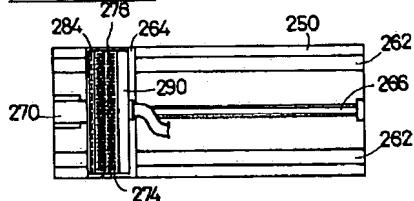
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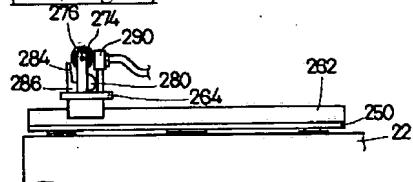
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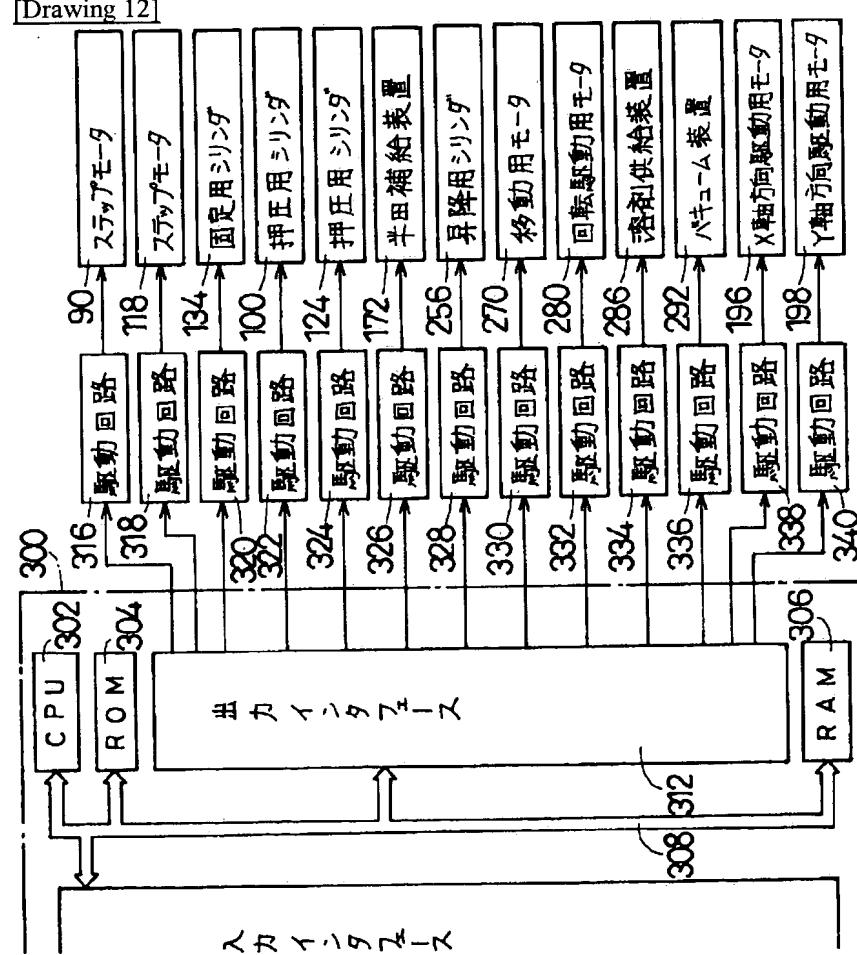
[Drawing 10]



[Drawing 11]



[Drawing 12]



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